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Uddeshya Upadhyay

Undergrad student in second last year pursuing dual degree (B.Tech + M.Tech) in Computer Science from **IIT-Bombay**.
Interested in **Machine Learning, Deep Learning, Computer Vision, Medical Image Computing, Image Processing**

Education

2015–2020 **(B.Tech + M.Tech) Computer Science and Engineering**, *Indian Institute of Technology-Bombay*, *8.28/10*.

2015–2020 **Minor in Physics**, *Indian Institute of Technology-Bombay*, *9.0/10*.

Publications

- **Robust Super-Resolution GAN, with Manifold-based and Perception Loss**
  Uddeshya. U, Suaysh. P. Awate, *IEEE International Symposium on Biomedical Imaging (ISBI), 2019*
  (Full oral presentation), *(copy available on request)*
- **Spinal Stenosis Detection in MRI with Modular Coordinate Convolutional Attention Network**
  Uddeshya. U, Badrinath. S, Meenakshi. S, *IEEE International Joint Conference on Neural Network (IJCNN), 2019*
  (copy available on request)
- **Removal of Batch Effects Using Generative Adversarial Networks**
  Uddeshya. U, *IEEE International Conference on Bio-engineering for Smart Technologies, 2019*
  (under review), *(copy available on request)*

Research Experience

Spring-2018 - present **Research Assistant**, *Medical Image Computing*, IIT Bombay.
Supervisor: Prof. Suyash P. Awate
- Working on deep learning based semi-supervised methods to remove surgical smoke from laparoscopy surgery video
- Proposed semi-supervised quality enhancement scheme using GANs based on perceptual loss

Spring-2018 - present **Research Project Student**, *CSRE*, IIT Bombay.
Supervisor: Prof. Biplab Banerjee
- Proposed *class specific coders* based learning scheme to train recognition models in low data regime
- Implementing proposed scheme to train deep learning models with limited *aerial and SAR* images which are prominent in remote sensing, to do various classification tasks

Summer-2018 **Research Intern**, *Honda Research Institute*, Japan.
Supervisor: Dr. Eric Nichols
- Worked on deep learning models for sequential tagging problems in NLP and unsupervised language models
- Proposed residual connection based algorithms achieving better results than state of the art on POS tagging
- Implemented architectures using character level features for tagging problems like POS, NER and compared them with existing state of the art systems

Autumn-2018 **Research Assistant**, *ViGIL*, IIT-Bombay.
Supervisor: Prof. Suyash P. Awate
- Worked on generative models such as VAEs, GANs to generate super resolved *Histopathology microscopy slides*
- Proposed deep residual network based autoencoder to extract useful features from microscopy slides
- Implemented Super Resolution GAN and introduced a new variation using Wasserstein metric to improve stability in training and structural similarity of generated images
- Proposed methods to make Super Resolution GAN robust to outliers/noise in low-resolution input domain ***(research work accepted at IEEE ISBI-19)***

Summer-2017 **Research Assistant**, *HESL-Nanyang Technological University*, Singapore.
Supervisor: Prof. Anupam Chattopadhyay
- Designed and implemented a library capable of performing various side channel attacks such as Correlation Power Analysis, Template Attacks, Differential Power Attack, Mutual Information Attack on block ciphers
- Trained Convolutional Neural Network to build templates for attacks from power traces and performed comparison with templates obtained by modelling traces as Multivariate Gaussians

Autumn-2018 **R&D Thesis-1**, *ViGIL*, IIT-Bombay.
Supervisor: Prof. Arjun Jain
- Implemented a novel architecture to recognize actions of humans in video using 3D and 2D pose estimates by processing 2D projections of pose in stacked Bi-LSTM network
- Trained model to achieve action recognition accuracy of 82.57% on video dataset of 17 different actions

Work Experience

Winter-2018 **Research Intern**, *Synapsica*, Bangalore.
- Developed a novel multi-stage deep learning solution leveraging *coordinate convolutions* to detect spinal stenosis using axial MRI scans of spinal cord (***research work accepted at IEEE IJCNN-2019***)
- Implemented unsupervised method based on template matching to locate lumbar disks in sagittal spinal MRI

Winter-2017 **Deep Learning Intern**, *Fractal Analytics* , Mumbai.
- Implemented real time face detection and recognition module in python using deep learning model FaceNet
- Used Multi-task Cascaded Conv-Nets (MTCNN) as face detection module to extract faces in real time
- Implemented ensemble of Xgboost, SVM and feed forward networks to achieve 93.7% classification accuracy for 150+ people

Autumn-2016 **Teaching Assistant**, *Quantum Physics and Applications*, IIT-Bombay.
- Responsibilities included solving problems and doubts in weekly tutorials, conducting and grading exams

Winter-2016 **Data Science Intern**, *Julia Computing* , Bangalore.
- Implemented K-means algorithm to cluster data from multiple files in parallel to boost performance of clustering in JULIA and worked on Generalized Regression Model to predict cost on basis of journey distance, time from New York Taxi Dataset
- Analyzed variation in pickups and drop-offs with years/month/weekdays/hours in day to discover patterns
- Did visualization of results on Heatmaps using Google maps API and various 2D and 3D graphing engines

Key Projects

Autumn-2018 **XTBTorch**, *Tuberculosis detection in X-ray scans using deep learning*, IIT-Bombay, [code].
- Implemented a deep residual network to detect tuberculosis from a public repository of X-ray scans

Autumn-2018 **GrayM-Seg**, *Spinal Cord Gray Matter Segmentation*, IIT-Bombay.
- Designed a Generative Adversarial Network to perform gray matter segmentation in spinal cord MRI scans
- Implemented a U-Net based generator optimizing a combination of dice score with adversarial loss term and a Conv-Net as discriminator

Autumn-2018 **Plastic DNNs for vision tasks**, *Neuromorphic Engineering*, IIT-Bombay.
- Implemented differentiable plasticity using *Hebbian rule* for linear layers in deep neural network
- Studied the performance of vision based tasks in deep learning such as auto-encoding (reconstruction) in presence of noise and image classification using plastic layers in deep neural networks

Autumn-2018 **Neurapse**, *Neuromorphic Engineering*, IIT-Bombay, [code].
- Developed open source library Neurpase for Simulating spiking neural networks
- Implemented neuronal models such as LIF, AEF, Hodgkin-Huxley, Izhikevich
- Implemented Spiking Neural Network models with different STDP rules, complex models like Dynamic Random Networks

Autumn-2017 **Texture Optimization Synthesis**, *Digital Image Processing*, IIT-Bombay, [code].
- Implemented a classic texture synthesis algorithm based on energy optimization of samples
- Implemented EM optimization technique to optimize energy equation at every step in multi-level synthesis
- Improved proposed algorithm by processing the **YCbCr** channel to cut running time by one-third while preserving quality of synthesis

Summer-2017 **Zypher**, *Research Internship*, NTU-Singapore, [code].
- Developed an open source library in JULIA to perform side channel attacks on block cyphers
- Implemented attacks such *correlation power attacks*, *template attacks* on the power traces from cyphers

Spring-2017 **Zick: Messenger Chatbot**, *Hack U, Yahoo Japan*, IIT-Bombay, [code].
- Designed chatbot for facebook's messenger application which can recommend movies, songs and articles to users
- Implemented back-end in python and hosted it on heroku server as heroku app

Autumn-2017 **Leasify : Leasing made simple**, *Database and Information Systems*, IIT-Bombay.
- Developed an online platform along with the android app allowing people to lease out any commodity in their locality
- Designed database schema and the back-end from scratch using python and Django
- App features location based search and ads, security contract and rating based system

Summer-2016 **Mani Mouse**, *Institute Technical Summer Project*, IIT-Bombay.
- Developed algorithm to detect hand gestures and movement in real time
- Applied transformations such as erosion and dilation of the frames to smoothen out and filter required regions
- Used gestures and movements to move cursor and simulating mouse actions using PyAutoGUI and OpenCV

Spring-2016 **Feedér : Feedback application**, *Software Systems Lab*, IIT-Bombay.
- Developed an Android app Feedér allowing registered students to give real time, anonymous feedback to instructors
- Implemented interactive GUI for application using libraries such as volley and caldroid
- Developed corresponding webapp for instructors, using Django and SQlite database in back-end
- Application allows instructor to login and update information regarding course and assignment deadlines in real time

Scholastic Achievements

- Awarded **branch change** to **Dept. of Computer Science and Engineering** for **exceptional academic performance** in 2015-16
- Secured **All India Rank 2834** in **JEE Advanced-2015** out of **0.15 Million** Candidates
- Secured **99.81 percentile** in **JEE Mains-2015** out of **1.5 Million** Candidates
- Received a certificate of merit and a letter of appreciation from the honorable **HRD Minister of India (Smt. Smriti Irani)** for **exceptional performance** in the **CBSE AISSCE**, 2015
- Received **Kishore Vaigyanik Protsahan Yojana (KVPY)** Scholarship, instituted by the Department of Science and Technology, Govt. of India, with **All India Rank 299** out of **60,000** Candidates, 2014

Technical and Personal Skills

- **Programming Languages:** C, C++, Python, Matlab, Julia, Octave, TeX
- **Web & APIs:** HTML, CSS, Javascript, PHP, MySQL, AJAX, JSON
- **Tools & Libraries:** Tensorflow, Pytorch, Keras, FluxML

Course Works

Some of the relevant course works completed as part of my studies at IIT Bombay

- **Maths:** Linear Algebra, Multivariate Calculus, Probability and Statistics
- **Machine Learning/ Deep Learning:** Data Analysis and Interpretation, Fundamentals of Machine Learning, Artificial Intelligence, Digital Image Processing, Medical Image Computing, Computer Vision

References

- Up to 3 references available on request